Turbulence Equations

Dispersion: ◉ Standard ○ Short Range ○ Input TKE ○ Variance

The method by which the meteorological data are evaluated to determine the turbulent velocities, used in either the puff or particle computation is set in the advanced configuration menu. The default method is called "standard" and is defined by a similarity approach for vertical mixing and velocity deformation for horizontal mixing.

$$K_z = k\, w_h\, z\, (1 - z/Z_i)$$
$$K_h = 2^{-0.5}\, (c\, \Delta)^2\, |\, \partial u/\partial y + \partial v/\partial x\, |$$

Dispersion: ○ Standard ◉ Short Range ○ Input TKE ○ Variance

The turbulent velocity variance can also be obtained directly from the stability functions instead of through the intermediate step of computing a diffusion coefficient. This method is called "Short Range" and the boundary layer velocity variances are defined as a functions of u*, w*, and Z_i. This method does not use the diffusivity and no assumptions are required about turbulent scales. For instance, in the stable/neutral BL:

$$w'^2 = 3.0\, u_*^2\, (1 - z/z_i)^{3/2}$$
$$u'^2 = 4.0\, u_*^2\, (1 - z/z_i)^{3/2}$$
$$v'^2 = 4.5\, u_*^2\, (1 - z/z_i)^{3/2}$$

Dispersion: ○ Standard ○ Short Range ◉ Input TKE ○ Variance

If the TKE field is available, then the velocity variances can be computed from its definition and the previous velocity variance equations to yield relationships with TKE.

$$E = 0.5\, (u'^2 + v'^2 + w'^2)$$
$$w'^2 = 0.52\, E,\ u'^2 = 0.70\, E,\ v'^2 = 0.78\, E$$
$$u'^2 = v'^2 = 0.36\, w_*^2$$

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Some meteorological data sets may already contain the component turbulent velocity variances. This would normally be the case for data that have been generated from local measurement programs.